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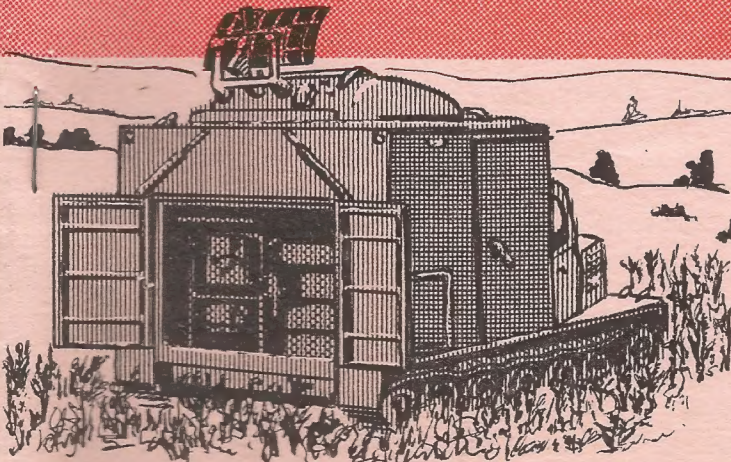


ARMY UNCLASSIFIED TECHNICAL INTELLIGENCE REVIEW



SUPPLEMENT

July 1972



Armour School
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INFORMATION BUREAU

**No
101**

ARMY TECHNICAL INTELLIGENCE REVIEW No 101 (SECRET)

SUPPLEMENT

JULY 1972

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S E C R E T
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ARMY TECHNICAL INTELLIGENCE REVIEW No 101 - SECRET

SUPPLEMENT JULY 1972

FOREWORD

Air Defence (AD) of the Field Army plays a very important part in Soviet thinking and they have invested considerable money and expertise in attempting to produce an effective answer to the problem. In this issue we take a look at two very important items of Soviet low level AD equipment, the 23mm SP AA Gun ZSU-23-4 and the SA-7 low altitude SAM.

ZSU-23-4 is probably the most effective very low level AD system in the world today. Since our first short article eighteen months ago we have improved our knowledge of the system in some respects, but there are still very considerable gaps which we hope our collectors can help us to close as soon as possible.

The latest appearance of the SA-7 in Vietnam is of considerable importance. We look forward to the results of the US exploitation with great interest. The threat posed will not be lost on our readers from Army Aviation.

There are three more staff changes to report. Major Norman Fincham has departed on promotion for command of a unit and Major Ian Kingswood has replaced him at the BW/CW and MT desks. Major Argie Haddock our resident American has departed for Fort Leavenworth and the Command and General Staff Course. His duties on the Artillery desk have been taken over by Major David Boobbyer fresh from the sharp end at BRIXMIS.

Finally, Major John Stevens on the Signals desk has left us for an appointment at the School of Signals and we welcome Major Richard Karl, a United States Signal Corps officer, to the chair.



S C SMITH
Col Tech Int(A)

1. New Version of the Soviet ARS-12 NBC Decontamination Bowser (SECRET)

Background

A third model of the Soviet ARS-12 decontamination bowser was seen for the first time in 1971. The two existing models, ARS-12D on the ZIL-151 chassis, and the ARS-12U on the ZIL-157 chassis have been in service for many years and are constantly seen in large numbers. The new model is mounted on the ZIL-131 chassis.

Whereas the ARS-12D and the ARS-12U, were, with the exception of the chassis, identical apart from some minor details, there are noticeable differences between these two earlier models and the latest one. The Soviet magazine "Technology and Armament" issue No 4 of 1971 mentions in an article entitled "Servicing of Special Equipment" by Engineer Lieutenant Colonel V Golovko an ARS-12M in addition to the known ARS-12D and ARS-12U. It is possible that this is the Soviet designation for the ZIL-131 based ARS-12. It is logical for the ARS-12 bowser to be mounted on the ZIL-131 chassis which is the vehicle currently replacing, in its cargo version, the ZIL-157.

Role of the ARS-12

The ARS-12 is primarily used for deactivation, disinfection, and decontamination of vehicles, equipment and ground (see figures 1, 2 and 3). However it can also be used as a simple water tanker or as a bulk tanker for carrying decontaminating and disinfecting mixtures to replenish smaller decontamination equipments (see figure 4). The ARS-12D could also be used to disseminate smoke from discharge pipes but this is not a function of the ARS-12U and probably not of the ZIL-131 version. A maximum of 8 large items can be decontaminated simultaneously by the ARS-12 using hoses which are a part of the vehicle equipment. Water, or water to which decontaminating and disinfecting chemicals have been added, is delivered under variable pressure to nozzle or brush headed hoses. This is illustrated in figures 1 and 2. Different hoses are attached to the ARS-12 discharge pipe for ground spraying as in figure 3. All models of the ARS-12 are believed to consist basically of a bulk tank, a pump powered by the vehicle engine, a hand pump, plumbing and a range of hoses and accessories. The ARS-12D and U have a tank capacity of 2,500 litres and the ARS-12 on ZIL-131 is believed to have a similar capacity.



Fig 1. ARS-12D Spraying

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)



Fig 2. ARS-12U
Decontamination using
Brush Headed Hoses.
The Hose Storage
position in the right
hand side lockers can
be seen.



Fig 3. ARS-12D in Ground Decontamination Role

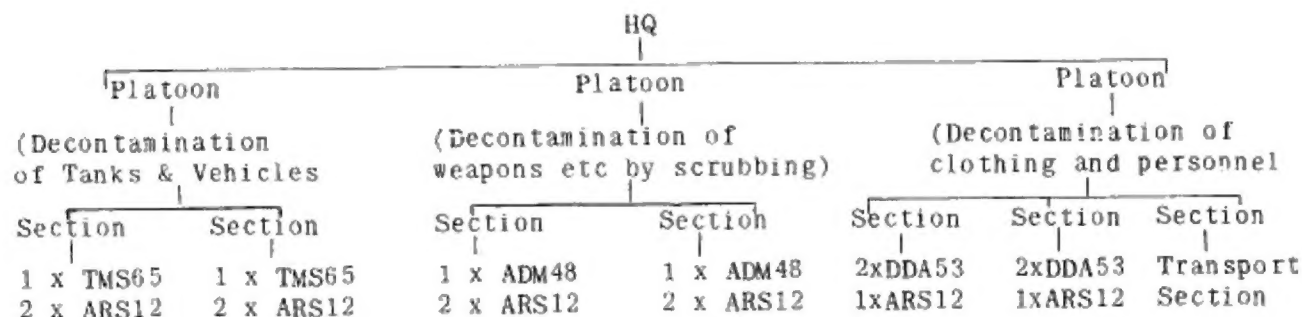


Fig 4. ARS-12D providing water for improvised
tank of Decontaminating fluid.

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)

Holding

Within the Divisional Chemical Company there are twelve ARS-12 decontamination bowzers as shown below.



At Army level the Chemical Battalion has thirty ARS-12 decontamination bowzers.

Technical Characteristics

The outline technical characteristics of the chassis on which the ARS-12 models are mounted are as follows:

	ZIL-151 (ARS-12D)	ZIL-157 (ARS-12U)	ZIL-131 (ARS-12M?)
First production	1947	1958	1965
Drive	6 x 6	6 x 6	6 x 6
HP	92	109	150
Wheel base (extreme axles)	4885 mm	4785 mm	4610 mm
Weight (cargo version)	5580 kg	5450 kg	6700 kg

It will seem that each successive model of the ARS-12 bowser is mounted on a more powerful, shorter wheel base chassis, giving it the potential for higher road speed, greater cross country mobility, and better overall reliability.

Differences between the models of the ARS-12 Bowser

The ARS-12D and the ARS-12U bowzers were identical except for minor differences (see Figs 5, 6, 8 and 9) but on the latest model (ARS-12M?) the manual pump has been moved from the rear left-hand side of the tank to the forward left-hand side. Four carrying hoops have been positioned below the manual pump and a metal drum which may contain decontamination chemicals is sometimes seen clamped in these hoops (see Fig 7). Other drums are also, on occasions, seen to be carried on the side lockers and a form of racking has also been seen on the top of the lockers of some ARS-12M? presumably to facilitate the carrying of drums. Both the ARS-12D and U have also been seen frequently carrying drums in this position (See Fig 13). It is known that for Exercise DVINA some ARS-12U were fitted with wooden racks on the top of the side lockers and drums of different concentrated standard Soviet decontamination solutions were carried on them. This, it is claimed, increased significantly the capability of the ARS-12U to decontaminate weapons and material. It is not surprising therefore, to find racks built in the same position on this new version of the ARS-12 bowser and it is logical to assume that the drums carried on them also contain standard decontamination chemicals.

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)

Extra lockers have been positioned on the left-hand side behind the cab, in the area which on the ARS-12D and U is occupied by the vehicle spare wheel. This can be seen in Figs 7 and 14. We do not know the reason for this additional locker space but it could be designed to carry:

- a. Decontamination chemicals. This seems unlikely as drums have been seen to be carried on the top of the lockers.
- b. Additional Hoses and Accessories.

There appears to have been some reorganisation of the equipment carried in the side lockers as the left-hand locker on the ARS-12M? has a cranking handle at the end of the case unlike the ARS-12U on which a similar handle is found on the right-hand locker. This can be seen in Figs 9 and 10. It could be that the left-hand side lockers on ARS-12M? are now used to store hoses which on the ARS-12U were in the right-hand lockers.

Figures 5 to 14 show various views of the three models and illustrate the differences between them.

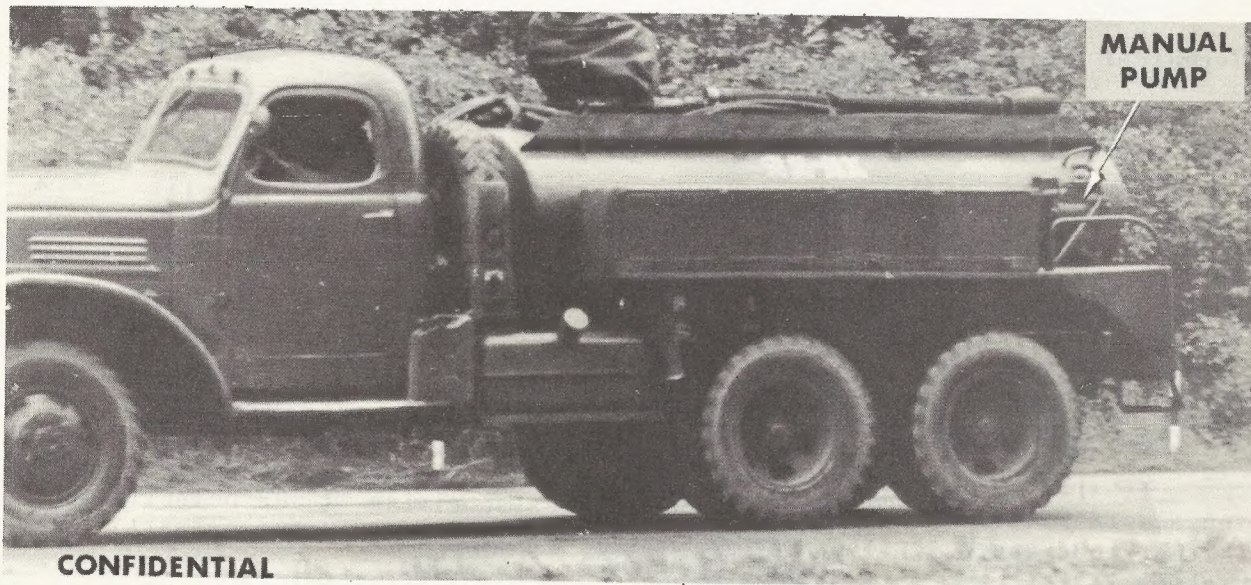


Fig 5. ARS-12D - Left hand side. The position of the manual pump at rear of lockers can be seen



Fig 6. ARS-12U - Left hand side. The manual pump can be seen in the same position as on ARS-12D

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)

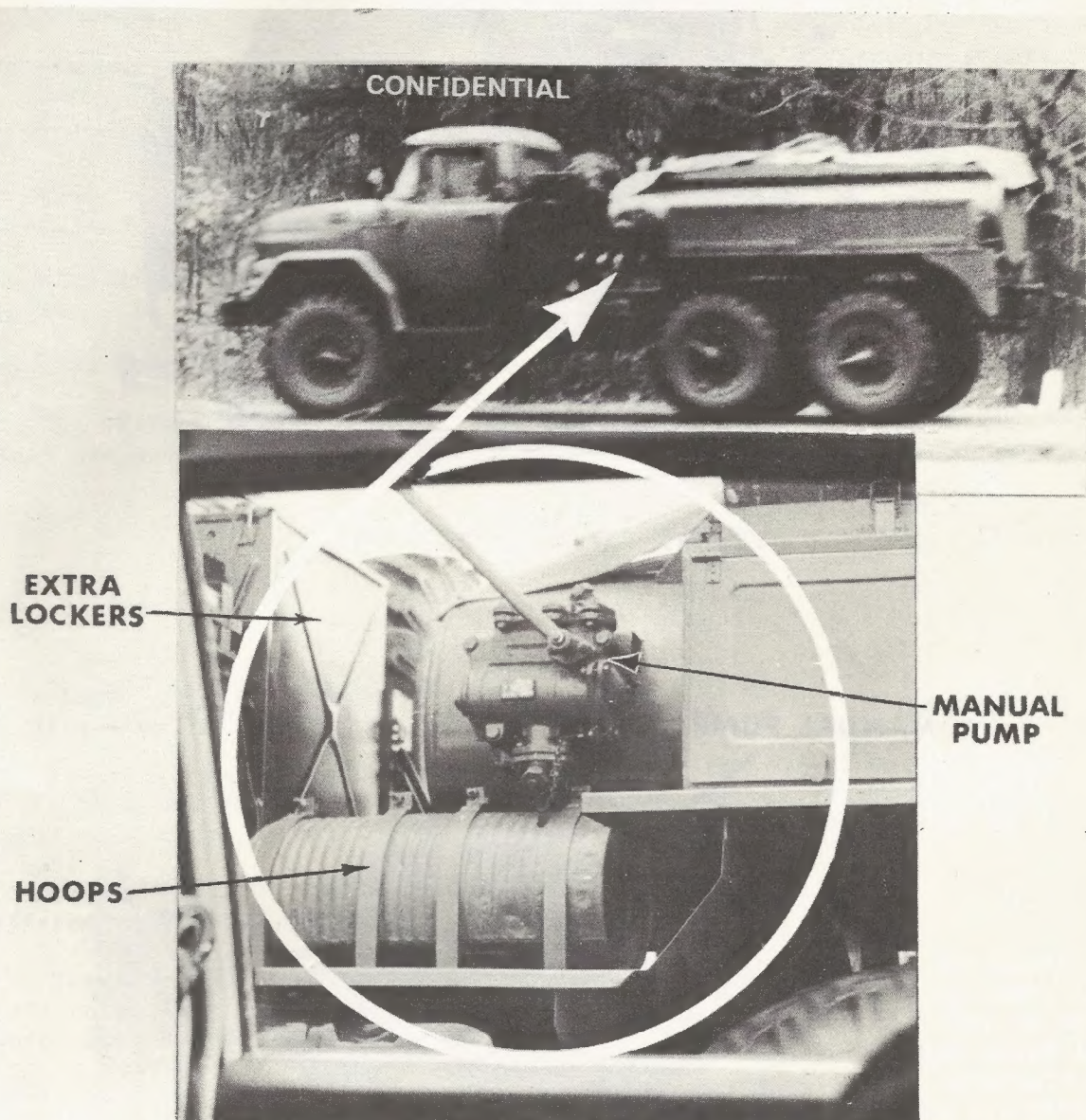


Fig 7. ARS-12M? on ZIL-131 chassis, left hand side. The new position for the manual pump forward of the lockers and the drum carrying hoops, with and without a drum, can be seen. The extra lockers behind the cab can also be seen.

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)

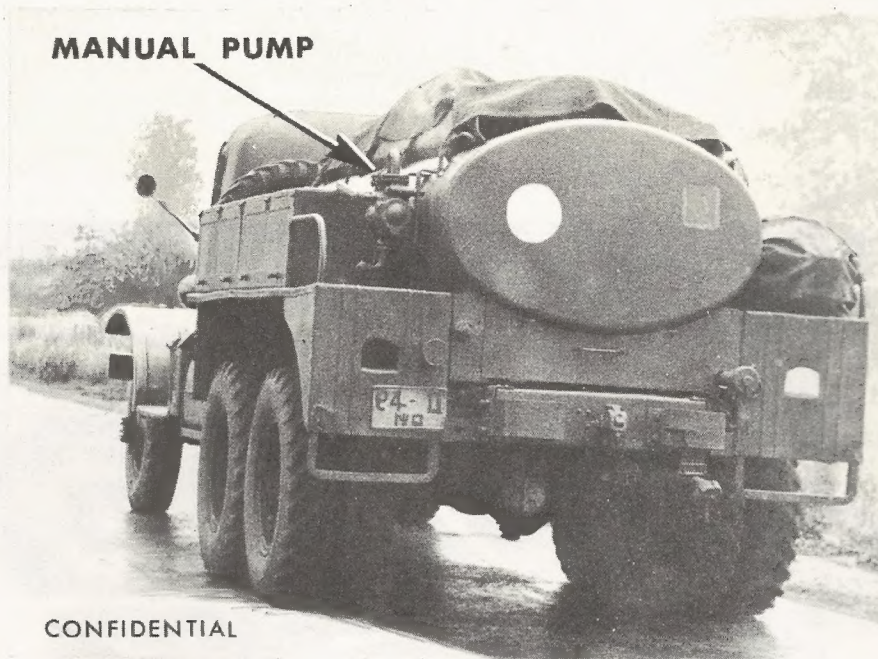


Fig 8. ARS-12D Rear View

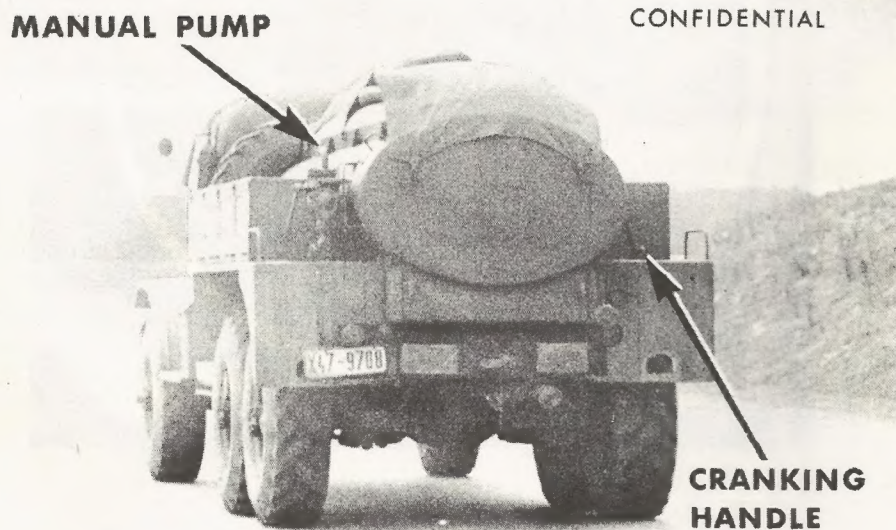


Fig 9. ARS-12U Rear View. Almost identical with ARS-12D (Fig 8). The cranking handle at the end of the right hand side lockers can be seen

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)



Fig 10. ARS-12M? on ZIL-131. Rear View. The new position of the cranking handle in the side of the left hand side lockers can be seen.

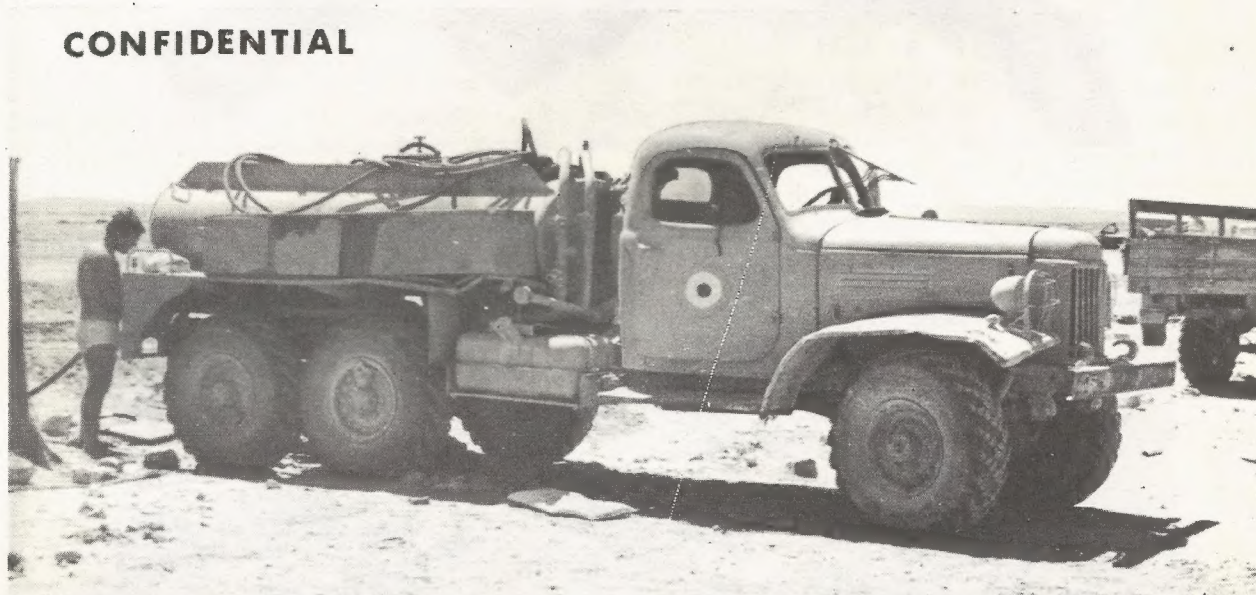


Fig 11. ARS-12U. Right hand side

New Version of the ARS-12 NBC Decontamination Bowser (Cont'd)

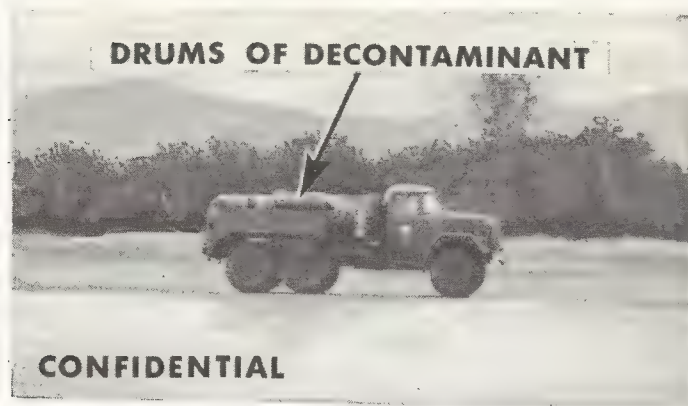


Fig 12. ARS-12M? on ZIL-131. Right hand side. Showing little appreciable change from ARS-12U in Fig 11. It is of interest that drums are being carried on the side lockers of this latest version of ARS-12 as the previous models (see figs 6 and 13)

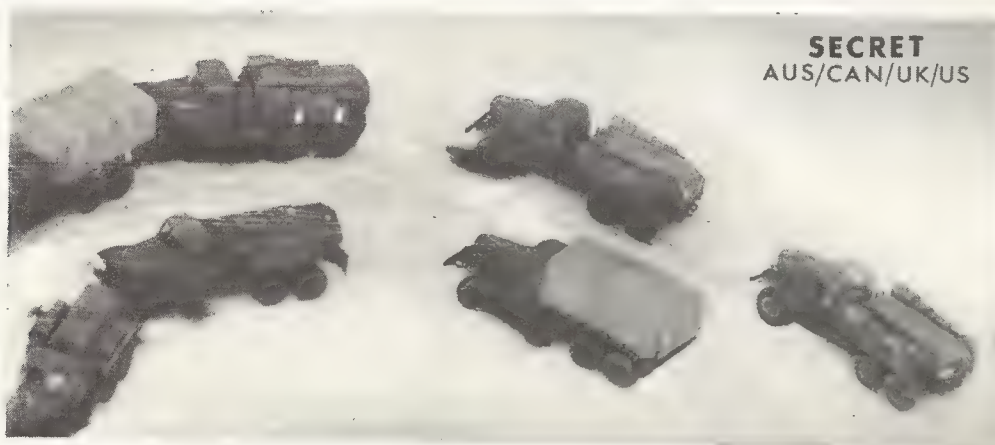


Fig 13. ARS-12U

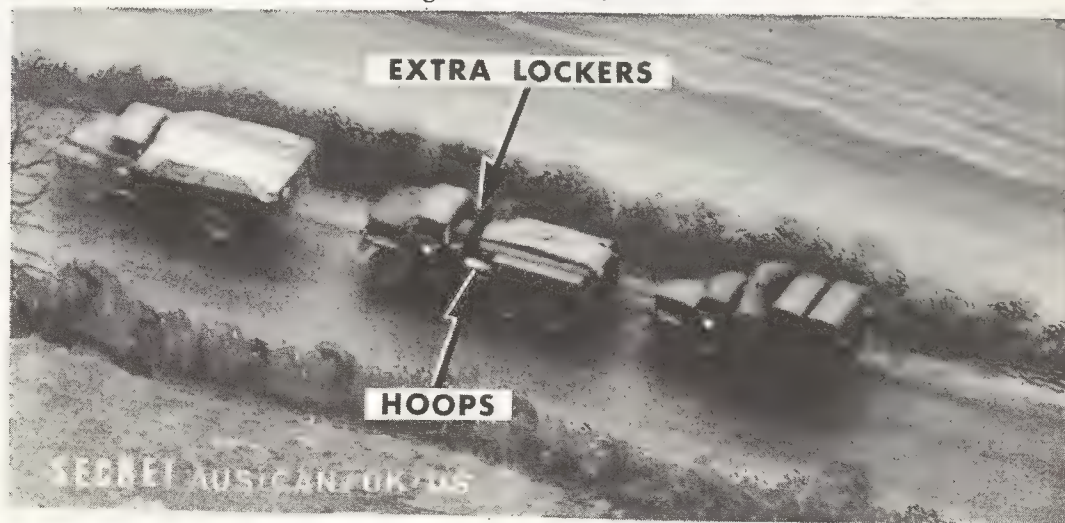
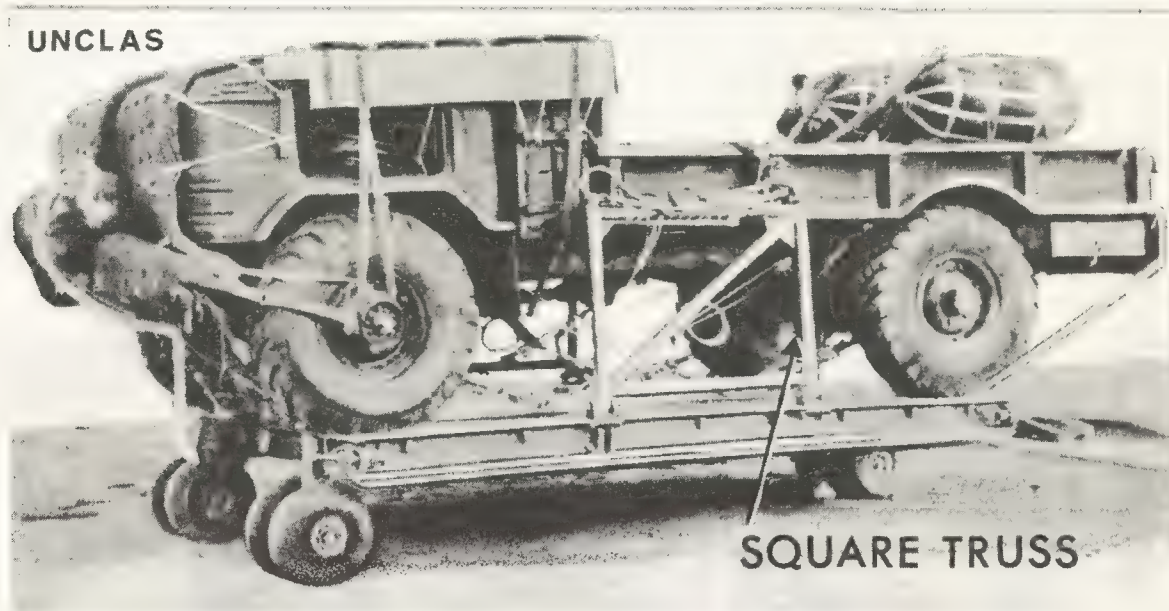


Fig 14. ARS-12M? on ZIL-131

2. Soviet Heavy Drop Equipment (CONFIDENTIAL)

HEAVY DROP PLATFORM PP-128-5000 (CONFIDENTIAL)

This platform was mentioned in connection with the air-dropping of BRDM, in ATIR No 95 (October 1969). It is a lightweight, all metal, stressed platform measuring 12.3 feet by 7.4 feet. These dimensions differ from those given in ATIR No 95 and are the result of a reassessment. The parachutes are attached directly to the trusses of the platform. For recognition purposes, the obvious differences between this platform and the smaller PP-127-3500, are the square strusses at the sides of the PP-128-5000 (Fig 1) rather than triangular type, and the absence of the two large side-wheels which are normally present on the PP-127-3500. The platform may well be used with the retro-rocket system PRS-3500 or some similar system.



**Fig 1. Soviet Heavy Drop Platform PP-128-5000
with a GAZ66B rigged for Air Dropping.**

Soviet Heavy Drop Equipment (Cont'd)

Very Heavy Drop Capability (Confidential)

The Soviet Light Tank M-1970 described in ATIR (Supplement) No 100, is associated with airborne troops, and thus might be air-droppable. Although there is no conclusive evidence, there is a possibility that BMP could be air-dropped, and the Airborne Assault Gun ASU 85 by virtue of its association with airborne units might also be in the air-droppable category.

The current heavy drop platforms (PP-127-3500 and PP-128-5000) would not accommodate any of these vehicles. If however, the object in Figure 2 is an air-drop platform, its major dimensions would be of the following order:

Length: 5.18 m (17 ft)

Width: 3.05 m (10 ft)

These dimensions would be sufficient to permit the carriage of the Light Tank M-1970, BMP or ASU 85 for air-drop. However at this stage since its weight capacity is an unknown factor, we must turn to the collectors to obtain more information and photography to enable a more detailed assessment to be carried out.

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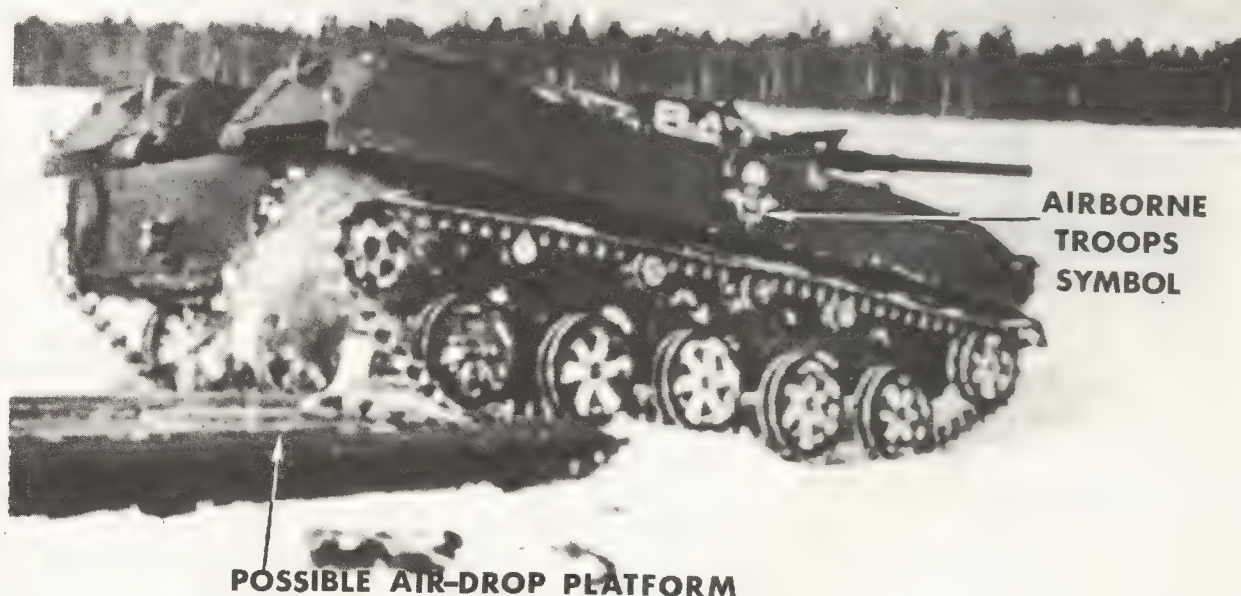


Fig 2. Very Heavy Drop Platform (?)
and Soviet Light Tank M-1970

3.

23mm SPAA Gun - ZSU-23-4

(SECRET AUSCANUKUS)

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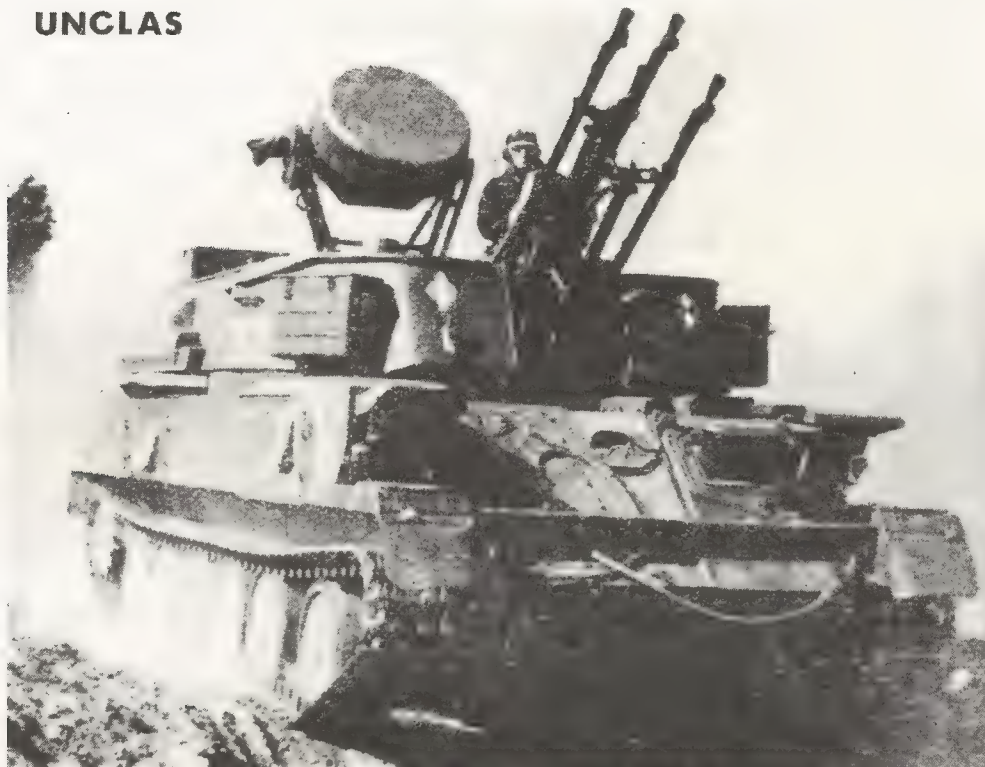


Fig 1. Early Model in Polish Service

Introduction

ZSU-23-4, the Soviet made, self-propelled, quadruple mounted 23 mm AA equipment, with its own on-board fire control radar, GUN DISH, was last covered in ATIR Supplement No 98 of January 1971 and in ATIR Digest No 98 of February 1971. In both cases, only outline information was provided, some of which is now out of date, due to changes in our assessment of the equipment or to new information. The purpose of this article is to up-date the previous articles, to provide more detailed background information, and, as far as possible, to assess ZSU-23-4's performance and capabilities.

Background

ZSU-23-4 was first seen by the West on the Moscow Parade in November 1965. Since 1968, it has been introduced progressively into service with the Group of Soviet Forces in Germany, with the East German and Polish Armies and, in limited numbers, in Hungary and possibly Bulgaria.

It has also been deployed at SA-3 sites in Egypt. These particular equipments are believed to have remained in Soviet hands, which might account for their curious association with SA-3, but it is possible that some have been or will shortly be handed over to the Egyptians. Finally, a limited number have probably been sold to Libya.

The total number produced so far is uncertain, but is likely to be about 700-1200 of which at least 600 are currently in service in GSFG, Poland and East Germany.

23 mm SPAA Gun ZSU-23-4 (Cont'd)

During its Service life to date, ZSU-23-4 has gone through a series of different models. The changes mostly concern the light metal structures on the side of the turret, which are believed to cover air-conditioning and/or liquid cooling equipment. This might indicate unacceptable rates of heat build-up inside the turret, necessitating a number of modifications before the problem was solved. The various models noted, with the year of first sighting, are shown in Figure 2. There have been no apparent modifications to the radar antenna or to the guns.



Fig 2. Models in Service up to 1972

23 mm SPAA Gun ZSU-23-4 (Cont'd)

Fig 2. (cont'd) Models in Service up to 1972



23 mm SPAA Gun ZSU-23-4 (Cont'd)

Deployment

One battery of the regimental AA battalion in both motor rifle and tank regiments is equipped with ZSU-23-4. Currently, 4 equipments are held by each battery, although this number may be increased in the future. The other battery in the AA battalion holds non-radar controlled equipments, 6 x 14.5 mm AA HMGs, ZPU-4 or 23 mm AA Guns, ZU-23, in motor rifle regiments, and 4 x 57 mm SPAA Guns, ZSU-57-2, in tank regiments. There are no separate surveillance or early warning radars in either type of battalion.

Equipments are probably allocated to units, on the orders of the regimental commander, as the situation dictates. They are often deployed in pairs, and may be given such tasks as march protection and protection of regimental hides, defiles, bridging sites and of HQs or nuclear delivery means in the forward areas.

Vehicle

The ZSU-23-4 vehicle is a modified PT-76 hull, probably with a certain degree of interchangeability of components. It is not, however, believed to be amphibious. The loaded weight is unknown, but is probably about 15 tons.

Crew

The vehicle carries a crew of 4, comprising the Commander, 1st and 2nd Gunners and the Driver.

Guns and Ammunition

The guns are believed to be basically the same as those fitted to the towed ZU-23, and to use the same ammunition. The single major difference is that the four guns of the ZSU-23-4 are liquid cooled. The purpose of this is almost certainly to allow longer cumulative burst lengths over a short period, before a barrel change is required, beyond the 100 rounds per barrel (6 secs of fire) of the ZU-23. The usefulness of this extension will be obvious when the difficulties of changing four hot barrels in an armoured turret, during or between engagements, and of finding stowage room for four spare barrels are considered.

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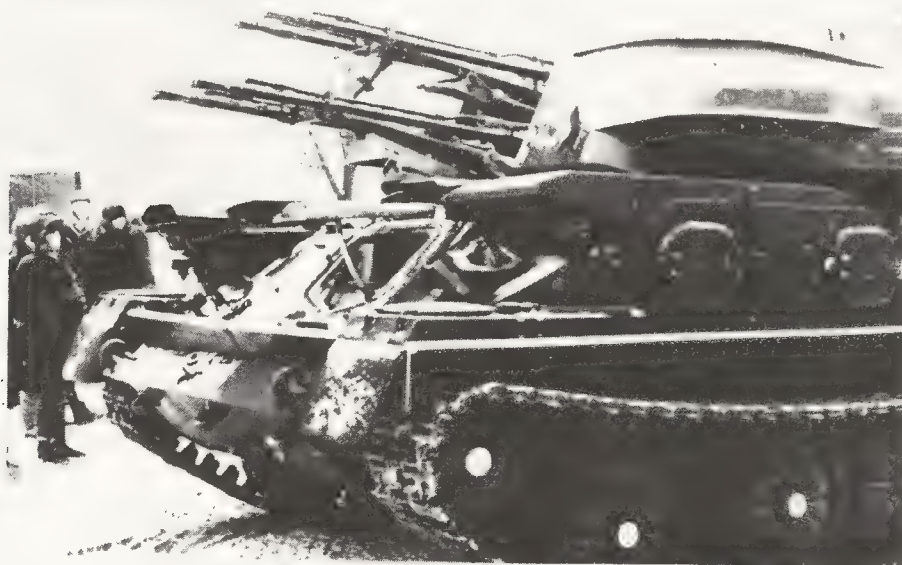


Fig 3. Quad Mounted 23 mm Guns

23 mm SPAA Gun ZSU-23-4 (Cont'd)

Assuming that the guns are basically the same as those in the ZU-23, the cyclic rate of fire is 900-1,000 rpm per barrel, giving 60-67 rounds per second for the whole equipment. The normal mix of ammunition is 3X High Explosive Incendiary-Tracer (HEI-T) rounds to 1X Armour Piercing Incendiary-Tracer (API-T).

The vehicle ammunition capacity is believed to be 2,000 rounds, loaded as 4 separate disintegrating link belts of 500 rounds each. Including the ammunition carried in battery soft-skinned vehicles, the total first line ammunition is believed to be 5,000 rounds per ZSU-23-4.

Radar

The technical characteristics of the GUN DISH radar are as follows:

- a. RF - J Band (14,500-15,400 MHz)
- b. PRF - 4216-5588 dpps
- c. PD - 0.1-0.6 microsecs
- d. Beam Width - 1.4° (estimated)
- e. Peak Power - 40-60 KW (estimated)
- f. MTI - Possible
- g. IFF - None
- h. Polarisation - Linear

The scan modes available are:

- a. Acquisition
 - (1) Possibly a circular scan mode at 5-15 secs per revolution.
 - (2) A bi-directional or slow scan, probably originated by movement of the radome and possibly manually controlled, at 5 - 15 secs per cycle. The frame times are very unstable, frame-to-frame.
 - (3) A uni-directional scan (ie with fly-back) at 22-25 Hz probably in quadrature with the bi-directional scan. This is sometimes superimposed on the bi-directional scan and possibly on the postulated circular scan.
 - (4) A Palmer scan, that is conical scan at 23.4-24.2 Hz, superimposed on the bi-directional or uni-directional scans. This may be a fault condition.
- b. Tracking
 - Conical scan at 23.4-24.2 Hz. A second conical scan mode at 61-68 Hz may be available.

23 mm SPAA Gun ZSU-23-4 (Cont'd)

The antenna is a folded feed, Cassegrain arrangement, probably using either a rotating solid sub-reflector or a nutating transreflector to provide the conical scan. The uni-directional sector scan at 22-25 Hz is probably provided by a rear feed organpipe scanner.

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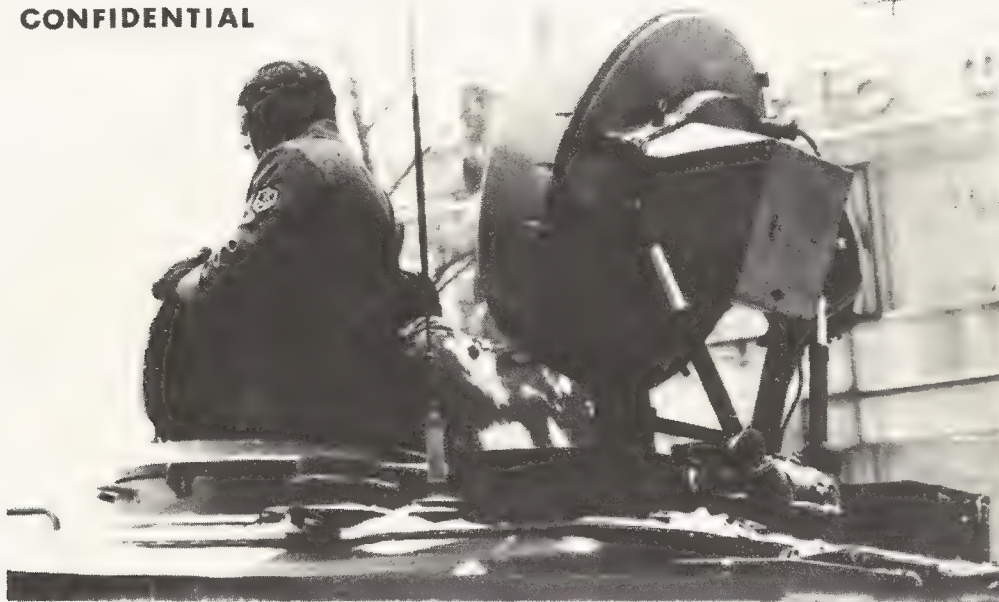


Fig 4. GUN DISH Antenna

Predictor

The on-board predictor is probably electronic and analogue in type, although it may be electro-mechanical, with a settling time of about 4-5 secs. From open press articles, the system is believed to include an engagement light which tells the crew when a target is within coverage. This might work by a continuous calculation of ground or slant range to the eventual point of impact, the light going on when this falls below a given figure.

Optical Sights

The two periscopic optical sights on the top of the turret, shown in Figure 5, are normally protected by the flower pot shaped covers. They are known to traverse independently in azimuth, and this fact, coupled with the short base line which would be available at high lead angles, makes it extremely unlikely that they form part of a coincidence or stereoscopic range-finder. The modes of fire control which are available are therefore probably as follows:

- a. Full Radar. Radar tracking in range, azimuth and elevation, using the predictor.
- b. Radar/Optical. Optical tracking in azimuth and elevation with radar range, using the predictor. This is probably the preferred mode.
- c. Full Optical. Optical tracking in azimuth and elevation, coupled with estimation of the range. The range might be injected manually into the predictor, or into a mechanical lead angle computing sight. After the first burst, corrections would be made using the tracer.

23mm SPAA Gun ZSU-23-4 (Cont'd)

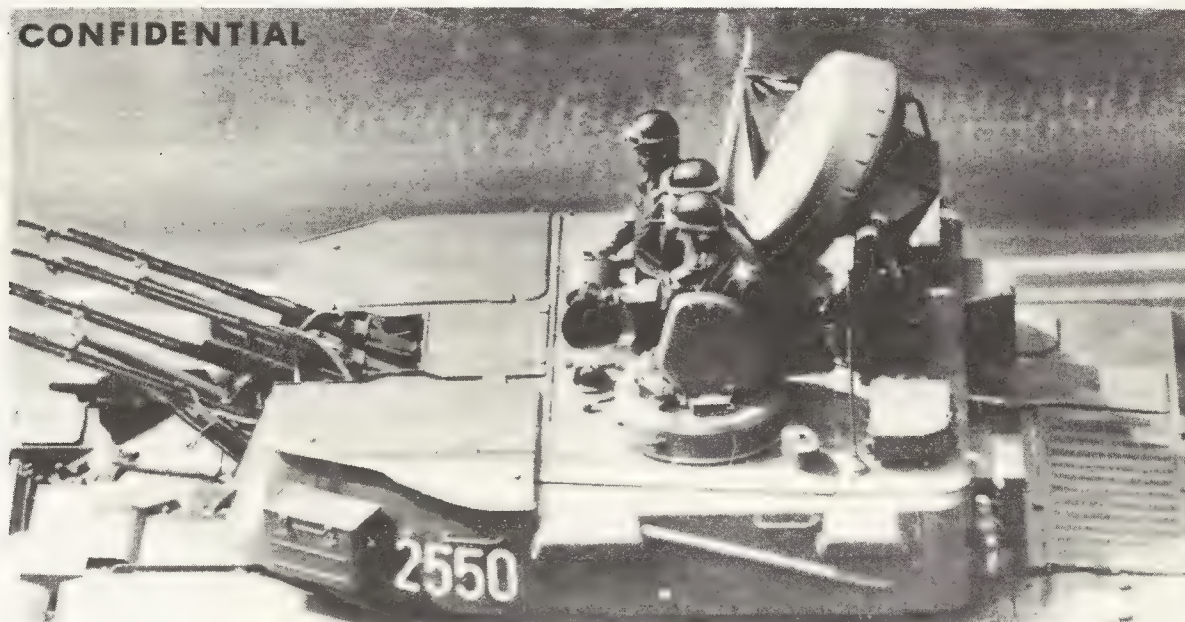


Fig. 5. Optical Sights

System Performance and Capabilities

The performance of the radar, and of the system as a whole, may be summarised as follows:

a. Maximum Acquisition Range.

- (1) Target at 150 ft - 7.9 kms (Estimated and power
- (2) Target at 300 ft - 10.2 kms) limited)
- (3) Maximum unambiguous range - 26 kms

b. Maximum Tracking Range.

Target at 300 ft - 5.7 kms (Estimated and tracking
elevation limited)

c. Reaction Time.

- (1) Acquisition-Track - 8-12 secs (estimated)
- (2) Track-Fire - 5 secs (estimated)

d. Impact Ranges.

Against fixed wing aircraft, assuming acquisition at 10 km:

- (1) 680 knots at 300 ft - 2,300 m (Estimated)
- (2) 450 knots at 300 ft - 3,000 + m (Estimated)

e. Minimum Radar Tracking Elevation - 1° (Estimated)

f. Maximum Effective Height and Range.

- (1) Height - 10,000 ft
- (2) Slant Range - 3000 m

23mm SPAA Gun ZSU-23-4 (Cont'd)

Against high performance, fixed wing aircraft, ZSU-23-4 is most effective when faced by low level attacks, without evasive manoeuvre. Evasive action, or the use of a dive attack profile will degrade its performance to a certain extent, this degradation becoming more significant as the angle of dive increases.

It is probably highly effective against all helicopters flying for any length of time above the minimum radar tracking elevation at ranges out to 3000 metres. In the case of gun-ships, which must approach within at least 2000 metres in order to deliver their weapons, it is probably effective, using optical tracking below the minimum radar tracking elevation, down to ground level. Its performance against artillery observation or visual reconnaissance helicopters will be limited by the short exposure times involved. ATGW helicopters, on the other hand, will, of necessity, expose themselves for considerably longer than the sum of the predictor settling time and the shell time of flight at all ranges. Nevertheless, even if GUN DISH has an MTI facility, the insignificant radial velocities of such helicopters will make them difficult targets to acquire by radar. If they remain below the minimum tracking elevation, optical tracking and estimation of range may be necessary.

Conclusion

ZSU-23-4 is probably the most effective very low level air defence system in service in the world today. Its mobility, its performance and its freedom from the need for external surveillance information make it an effective form of air defence for forward units. Nevertheless, it does have weaknesses. These include a sensitivity to terrain during the acquisition phase, and its apparent lack of IFF.

4. Soviet Anti Tank Weapon SPG-9

(SECRET AUSCANUKUS)

ATIR No 93 (April 1969) contained an article about a possible new Soviet Anti-tank Weapon B-1968(?). Since then, more information has been received, and the weapon has now been designated "73mm Recoilless Gun SPG-9". It has appeared in the inventories of USSR, Poland, East Germany, Bulgaria and Hungary, and is issued on the basis of two weapons per Motor Rifle Battalion.

It was initially thought that a spotting rifle was mounted on top of the barrel (Fig 1), but since this device has not been present on the weapon when sighted in operational settings, it is now considered to be a sub-calibre attachment for training purposes. SPG-9 is normally carried by two men, and fired from a tripod; there is however the facility for mounting the weapon on a small two-wheel carriage for towing, should the need arise.

The ammunition is rocket assisted, fin stabilized and carries a HEAT warhead which is estimated to be able to penetrate armour plate to a depth of approximately 425 mm when fired at a range of 800 m. The propellant charge (Figs 1 and 2) gives the round an initial velocity of 435 m/sec, and this is then boosted to 700 m/sec with the aid of the rocket motor (Fig 1).

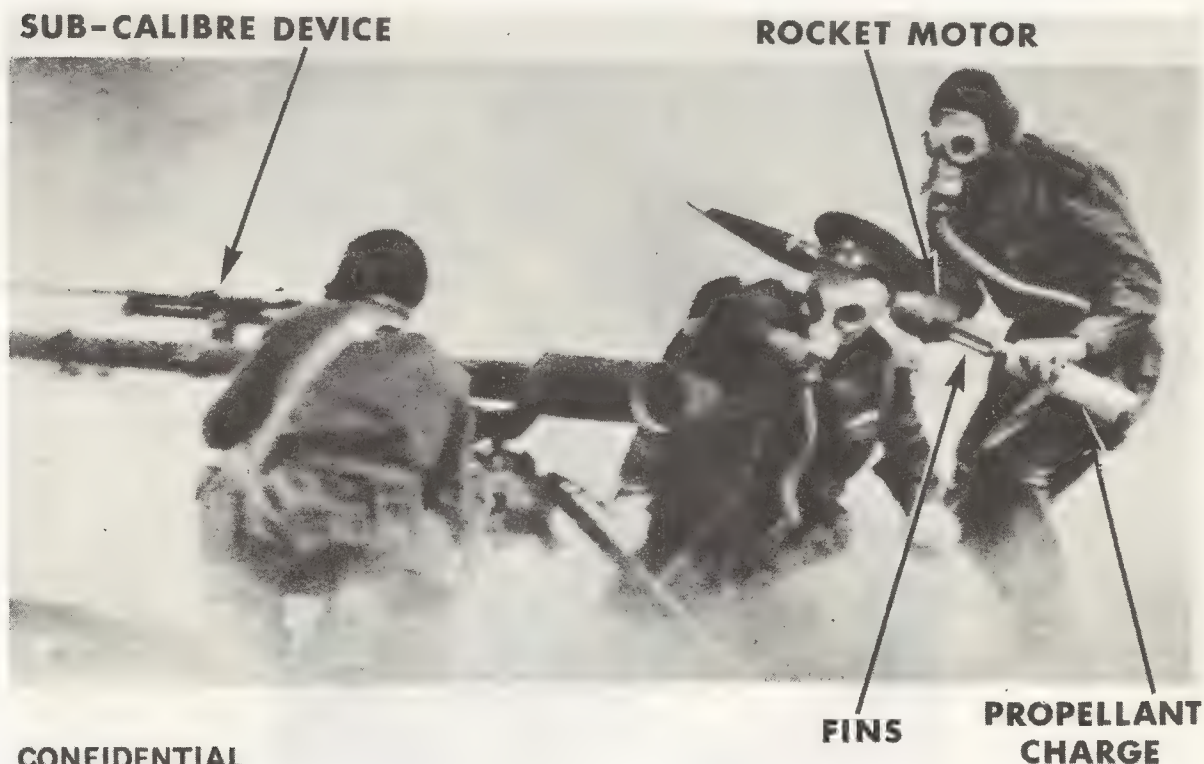


Fig 1. 73mm Recoilless Gun SPG-9

The current assessment of SPG-9 is:

Calibre:	73mm
Range-maximum:	1300m
normal:	800m

Soviet Anti Tank Weapon SPG-9 (Cont' d)

Muzzle Velocity:	435 m/sec
Maximum Velocity of Round:	700 m/sec
Weight of Launcher and Sight:	47.5 kg
Weight of Bipod:	12.0 kg
Length of Launcher:	2110 mm
Height of Launcher (in action):	800 mm
Sights - Type:	PGO-9 Optical
Magnification:	Times 4
Field of View:	10°
Ammunition:	HEAT, rocket assisted
Penetration:	425mm at 800m (Estimate)



Fig 2. Loading SPG-9

5. SA-7 Soviet Low Altitude SAM (SECRET AUSCANUKUS)



Introduction

The SA-7 manportable SAM system was first identified in Egypt where it was fired operationally during the confrontation with Israel though with very limited results.

The system has since been used with considerable effect in Vietnam against relatively slow flying targets. In May, this year, SA-7 firings have resulted in the shooting down of three piston engined aircraft (approximate speed 150 knots), and a helicopter, the latter receiving the impact of the missile in the centre of the turbine exhaust giving a firm indication of infra-red guidance.

There have been thoughts for some time that the Soviets might develop a manportable, low level SAM system along the lines of RED EYE. Such a system would be used to provide units with a means of protection against low level air attacks in forward areas.

It is now likely that SA-7 or an improved version of SA-7 will fill this role, though as yet, the system has not been seen with Soviet forces.

SA-7 Soviet Low Altitude SAM (Cont' d)

System Description

A SA-7 launcher (see Fig 1) complete with missile has been captured in Vietnam and an exploitation of the system is being carried out at the present time.

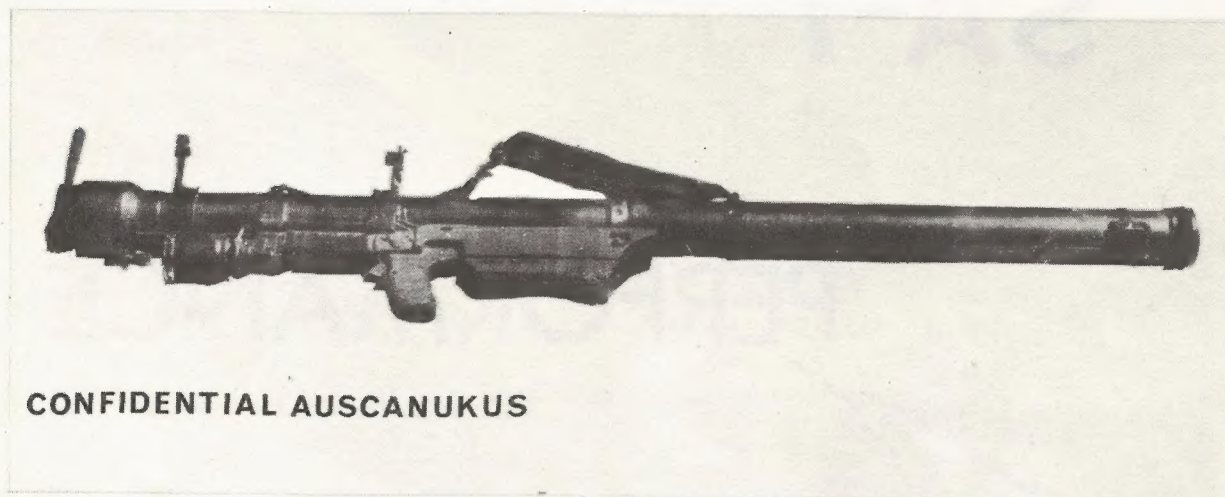


Fig 1. SA-7 Launcher

The missile is approximately 2½-3" in diameter, about 4-ft in length and weighs about 25-lbs. The HE warhead weighs approximately 2-lbs. The missile has four swept tail stabilisers and two unswept canard control fins. Photographs and firm details of the missile have yet to be received. The missile known to the Soviets as STRELA, has now been allotted the ASCC nickname 'GRAIL'.

The guidance mode is infra-red passive homing, the missile having an un-cooled, probably lead sulphide infra-red detector in its homing head which is only sensitive to fairly high temperature targets such as aircraft jet pipes or exhaust stubs. The rocket motor is a solid propellant motor.

System Performance

At the time of writing firm estimates of system performance from the exploitation of the captured SA-7 are not available. However a recent system evaluation, based on the missile size and assumed propulsion profile has led to the following estimates of performance.

Maximum range:	2.2 nm
Minimum range:	0.3 nm
Maximum altitude:	10,000-ft effective to 6,500-ft
Minimum altitude:	65-130-ft
Maximum target speed:	Subsonic

The results of a two-dimensional simulation of missile performance against a typical target flying at 500-ft per second and 750-ft per second are shown in Figs 3 and 4 respectively. Fig 3 shows performance against a 500-ft per second target straight and level. Both launch and hit zones are shown. The missile is limited against this target to a height of 5,000-ft at a launch range of just under 1.2 nm. It is constrained to fly against receding targets only. If the target is climbing the launch constraints will be altered and the launch

SA-7. Soviet Low Altitude SAM (Cont'd)

zone will change shape. Because of the overlap of the launch and hit zones it is possible for targets flying below about 3,000-ft to be engaged by a second missile if the first missile is seen to fail.

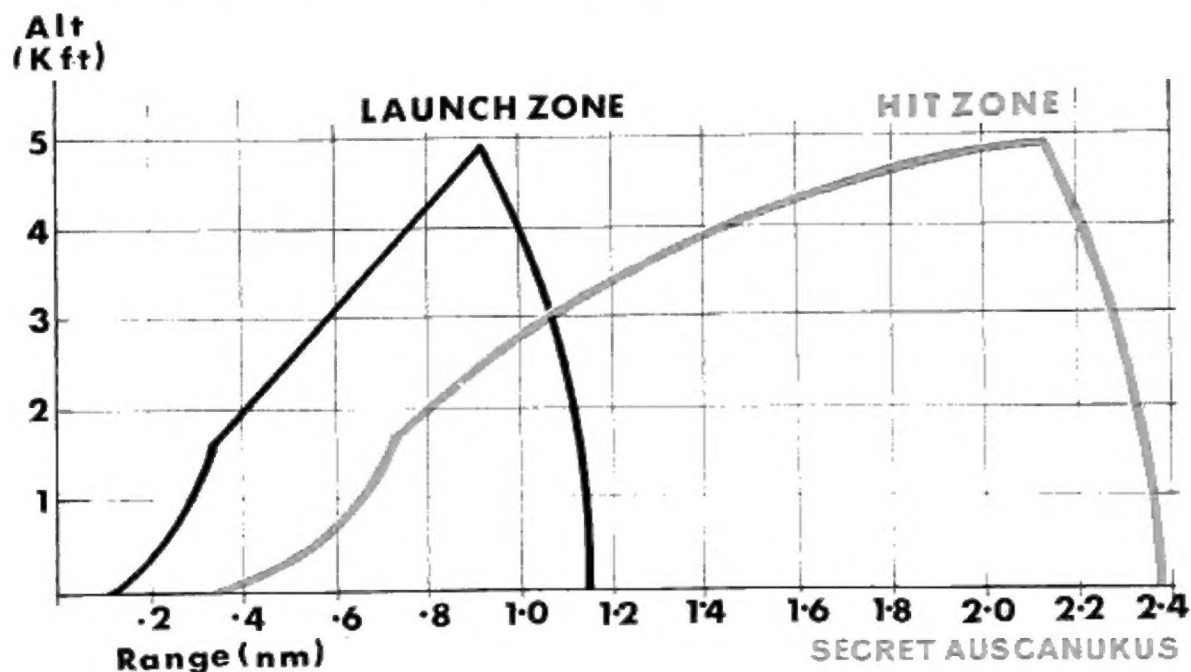


Fig 2. SA-7 500 ft/sec Straight and Level Target.

With a target speed of 750-ft per second (Fig 4) the zones shrink considerably. The maximum target height is now less than 2,500-ft and the maximum launch range has come down to less than 0.7 nm. There is no possibility of a second engagement. With a 1,000-ft per second target the zones shrink almost to insignificance.

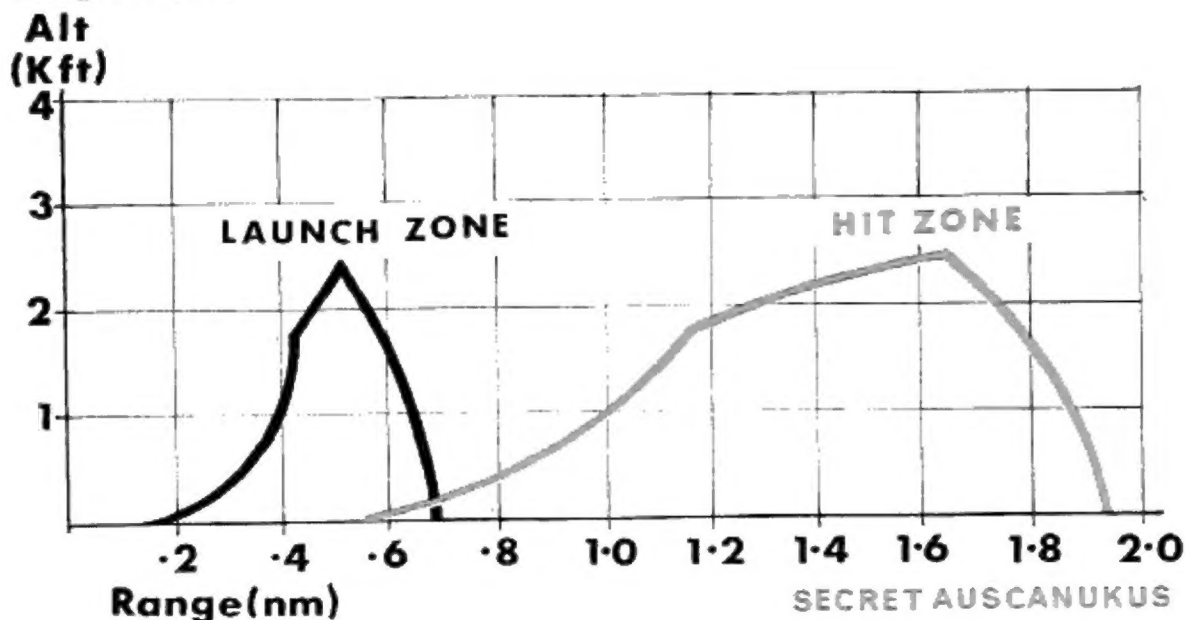


Fig 3. SA-7 750 ft/sec Straight and Level Target.

No surveillance radar is necessary to operate SA-7, but surveillance information would aid the operator in initial visual acquisition of the target and would thus reduce the overall reaction time.

SA-7 Soviet Low Altitude SAM (Cont'd)

Limitations of the Present System

The version of SA-7 used in Vietnam has an uncooled infra-red detector and can only lock onto fairly hot targets. This limits its use as far as jet aircraft are concerned, since it can only be fired effectively at receding targets. This means that since the missile has a limited propulsion capability, target speed is restricted as the missile must overtake the target.

This is also borne out by the effectiveness of the system against slow flying piston engined aircraft and helicopters, and its lack of real success so far against faster flying jet aircraft.

Future Developments

The non-appearance, so far of SA-7 with Soviet and Warsaw Pact forces may be an indication that an improved version of SA-7 is under development. This might include homing head cooling to make the system respond to lower temperature sources and consequently represent a significantly greater threat to low flying aircraft. However a preliminary examination of the captured SA-7 launcher indicates that it is a production model being made in some quantity.